SCIENCE

NEW SERIES
VOL. LIV, No. 1391

FRIDAY, AUGUST 26, 1921

SINGLE COPIES, 15 CTS.
ANNUAL SUBSCRIPTION, $6.00

SCIENCE

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MSS. intended for publication and books, etc., intended for review should be sent to The Editor of Science, Garrison-on-Hudson, N. Y.

WHOSE BUSINESS IS THE PUBLIC HEALTH?[1]

THE larger the field of usefulness of any science or art, the more obvious its applications, the greater is its danger of exploitation. Just as real estate and insurance attract the business incompetent so does public health attract the intellectual "piker." All things to all men, dripping with statistical odds and ends, full of startling though often uncontrolled results, stamped with the hall-mark of altruism, public health draws the well-meaning and self-seeking alike. Even when based on the greatest accuracy that science affords it often becomes essentially inaccurate through the medium of its interpreters and its employment.

In this large forest of accuracies and inaccuracies, of scientific principles and their application, it would seem that one should counsel simplification rather than elaboration—and yet my idea is that we have not thought of public health in a large enough way—we have indeed failed to see the woods for the trees. What then is public health?

Let us recall, to begin with, that "health" means a normal condition not only of body but of mind and morals as well. We may stretch our definition a little further and following Henderson demand that "health" include not only a normal individual but a normal environment. The business of public health then consists in the detection, correction and prevention of the maladjustments of human life, individual and collective. The forces of public health are engaged in war against "The Kingdom of Evil." Some of you may recall the service that Southard rendered social workers in offering them an orderly classification of their labors. The analy-

[1] Address read in a Symposium on Science and the Public Health before the Pacific Division of the American Association for the Advancement of Science, Aug. 4, 1921.

sis of social maladjustment, according to Southard (1), should first of all be on the basis of the individual rather than the family and should proceed by a "process of orderly exclusion," weighing in turn the significance of disease, vice, delinquency, ignorance and poverty. These, then, are the provinces of the kingdom of evil.

We should conceive the public health program as embracing and extending this field of social service. I find it easy to explain how public health embraces this inclusive scheme of Southard's, but more difficult to state just how it extends it, other than in the way of specialized correction. Social work can scarcely be confined to simple detection of evil, leaving its correction and prevention to a more inclusive public health. Social work may then be a mere synonym for public health but of course the social worker as now conceived would be only one of the cogs in the machine.

To re-define, it is the function of public health to spy out and remedy the "ills that flesh is heir to," to deal with the individual and collective problems of disease, ignorance, vice, crime and poverty. It is evident we have here the whole tissue of human altruism, and have far outstripped the meaning of public health in common speech. What then are the discrepancies between the term "public health" as currently employed and the larger definition which, with possible prevision, I have here given.

Let us here correlate very briefly recent information as to the scope of public health. There exist in this country several well-established curricula, schools, or institutes of public health. What are the vocational fields for which they train their students? In what do their courses of training consist?

There are several statements by experts on the careers that are open to properly qualified students in public health work. Vincent (2), Winslow (3) and Ferrell (4) have all expressed themselves on this matter and with considerable unanimity. We may construct from their articles a composite picture of the public health field as they conceive it, as viewed from the aspect of its opportunities.

One of the most interesting aspects of our field is that it offers opportunities of usefulness to individuals of several different degrees of intellectual training. Thus we find that a class "A" which we may designate as "skilled workers" is required: clerks, stenographers, accountants and laboratory technicians. These individuals after an ordinary high-school education are trained through apprenticeship.

Class B includes the "professional workers." These individuals are the specialists and their assistants, with collegiate and usually graduate training and comprise several groups:

1. Administrators: directors of public health schools, public health laboratories, bureaus and the like.

2. Laboratory workers: statisticians, bacteriologists, zoologists with various subgroups, immunologists, chemists and physiologists.

3. Field workers: public health nurses, sanitary engineers, epidemiologists, physicians, particularly school health officers, and social workers.

Although there is rather general agreement concerning most of these occupations and professions that together compose "public health" as now understood, it is evident that new groups are being added, that there are as yet "untilled fields," as Winslow has expressed it.

If vocational fields as ample as these exist, if tillers of these fields are in demand it is evident that they must be trained in other than the haphazard way that was necessary with the pioneers. Hence the "school of public health" the present conception of which now occupies us. A survey of the courses required and offered in four of the leading schools of public health in this country, Harvard-Technology, Yale, Pennsylvania and Johns Hopkins, shows certain accepted standards and suggests the lines of further advance that are contemplated. We shall not here concern ourselves with prerequisites and degrees granted but consider only what may be regarded as the fullest training offered.

It is evident that public health training for other than medical graduates requires practically the first two years as given in first class medical schools, that is, complete courses

in at least physiology, biochemistry and bacteriology. Anatomy is required at Hopkins and Harvard and the latter school also requires introductory pathology. It is evident that we are approaching the curriculum recently advocated by Sedgwick (5), who advised identical training for medicine and public health students for two years with divergent paths for two years more. Public health further requires somewhat more elaborate training of its students in certain branches of zoology, notably in parasitology, protozoology, helminthology and entomology, than is usually required of medical students.

Then come the medical and pre-medical sciences specifically applied to public health problems. Advanced physiology particularly of fatigue, respiration, climatology and ventilation; chemistry as applied to nutrition and metabolism, food, food adulteration and sanitation; bacteriology as applied in public health laboratories and to sanitary engineering.

And lastly are the public health sciences properly speaking: vital statistics, public health administration, sanitary law, sanitary engineering, epidemiology, school inspection, control of contagious diseases, and the like.

The total curriculum is certainly medical enough in aspect, which accounts for the very natural supposition in the minds of the general public and of many of the medical profession that public health is simply another specialty of medicine. How far wrong this conception is I shall hope to bring out a little later. Let it suffice here to note that the medical bulk of public health as outlined in schools of public health is preventive medicine and not curative medicine, medical science and not medical art. This is clearly brought out by the almost complete absence in all these curricula of the medical clinic. The hospital is not a necessary adjunct in public health training.

In finally considering the scope of public health we may glance at it as mirrored in current textbooks. Here at least no practical consideration of money or men need limit the field to be covered.[1] Again the main emphasis very properly lies in disease prevention with rather more emphasis than in the course outlines on certain correlated branches of personal hygiene and community welfare; the construction of dwellings; the question of clothing; the group care of infants and school children; health measures as applied to prisons, to armies, to transportation, and the tropics. A wider field is suggested by mention at least of such deeply specialized fields as mental hygiene (Park) and eugenics (Rosenau).

It is evident then from these summaries that public health is primarily concerned and properly so with the abolition of disease and in this campaign has enlisted the cooperation of many specialists outside the field of medicine. We suggest again that its future lies in the further assumption of the burden of combating ignorance, vice, crime, and poverty. What then is the actual and prospective personnel of the army of public health workers? Since disease is and will probably remain its most serious, tangible and defeatable enemy the man with a medical training is the most considerable figure in the scheme. Undoubtedly a full medical training remains the best foundation on which to base a further training in the broader field of public health. As an entire training medicine alone is inadequate, and to the type of mind that remains satisfied with accomplishment of the diagnosis and cure of an individual case of disease, it may even be detrimental. This is no place for the guild-consciousness of the practitioner of medicine. As a matter of fact the graduate in medicine is no longer of necessity the forwarder of those very sciences on which the art of medicine depends. If it be true that physiology, bacteriology, biochemistry and anatomy are progressing in the hands of non-medical specialists to the ultimate advantage of medical practise, this is even more true of the field of public health. No one would dream of asserting that one must have a medical training to be a good sanitary engineer, social worker, or criminologist. In this connection it is of interest to note that less than half the faculties of

[1] Rosenau (6), Park (7), and Abel (8) were consulted in this connection.

the Yale and of the John Hopkins Schools of Public Health are doctors of medicine.

May I point out then in conclusion that there are a number of fields of human endeavor that have been largely or entirely overlooked in efforts to present the scope of public health? They overlap each other and the fields already recognized.

The whole field of social economics has been notably neglected. The study of poverty, care of dependents, the question of housing from the standpoint of the inhabitant; some conception of city government, and the labor problem may be mentioned as contributory in this training.

Further consideration of industrial hygiene is necessary not simply from the standpoint of occupational diseases and accident prevention but from the aspect of labor education and efficiency.

There is a group of studies that may be included under mental hygiene: psychology; abnormal psychology; criminology, the studies of vice, and delinquency. Closely related thereto are the endeavors in child hygiene and child welfare, eugenics, juvenile court work and the like.

Somewhere in the scheme I am sure should come certain aspects of physical education as a building method of the healthy mind and body. And perhaps, as Vincent has suggested, we should consider some forms at least of proper publicity and education of the masses in the results of public health work.

The whole business of public health action then seems dependent on those who have specialized information in any one of the numerous branches that have and will comprise it. The further development of this art depends on those with successively larger visions of what's wrong with the world.

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THE ABORIGINAL POPULATION OF CALIFORNIA[1]

The only attempt to compute the aboriginal population of California is that of C. Hart Merriam in the *American Anthropologist* for 1905. His figure of 260,000 was obtained thus: In 1834 there were 30,000 converted Indians at the Missions. The addition of unconverted Indians within the Mission area would make 40,000. The population at the Missions had suffered a decline; correct therefore to 50,000 for aboriginal times. The Missionized area embraced one fifth of the habitable area of the state. The total would be 250,000; to which add 10,000 in the mountains and deserts.

This computation appears to err on the side of the area tapped by the Missions, which should be estimated at one third rather than one fifth of the total, reducing the result to 150,000 or 160,000.

Calculations gradually made during the past twenty years suggest a still lower figure, 133,000. This is the aggregate of the closest possible estimates which can be made for individual tribes and groups. For instance, a close survey of the Yurok shows them inhabiting between 50 and 55 settlements at the time of discovery. The houses averaged 6 per settlement, the inmates 7.5 per house. The total of approximately 2,500 for the Yurok, together with less complete data on number

[1] Abstract of a paper presented before the Section of Anthropology, American Association for the Advancement of Science, Chicago.

of settlements among neighboring tribes and valuations of their territory as to food supply, allows figures to be set for these other tribes. The figures for the entire district can then be used as a check on estimates made independently from local sources for other districts, due regard being given to variety of geographic conditions. In this way the total is arrived at.

The best early data are those from Spanish sources, which sometimes include approximate counts. Early American figures are usually impressionistic and exaggerated.

A check is furnished by the large Yokuts group. Here Moraga in 1806 computed 3,760 souls in thirteen tribelets, an average of 290. The inclusion of absentees might bring the figure to 350. Nearly 50 such tribes are known among the Yokuts, with a small part of their area unaccounted for. The total population of the stock thus was about 18,000. Its area embraced about one ninth of modern California and seems about average in food-supplying capacity. Multiplying 18,000 by 9 gives 162,000. A deduction of one fifth for the larger blocks of high mountain and desert areas brings the total to about 130,000; a reasonable verification.

Of course, no figure can be more than an approximation; but it seems at least highly probable that the native population fell between 120,000 and 150,000.

Even this total, the lowest ever arrived at, yields the unusual density of nearly one inhabitant per square mile for aboriginal California. Mooney's estimate is about 1,050,000 for the continent north of the Mexican boundary; 846,000 within the limits of the United States exclusive of Alaska.

The latter figure however, seems to contain Merriam's 260,000 for California. Reduced to conform to the new estimate of 133,000, the population of the United States would not much have exceeded 700,000, or one inhabitant per four square miles. In other words, more than a sixth of the Indians of this country were settled in California. A similarly heavy concentration seems to have held good for the Pacific coast of the continent as far north as Alaska.

The decrease of Indians in California has reached fully 85 per cent. in a century and a half. The factor most favorable to heavy decrease has been immediacy of contact with Caucasians and Caucasian civilization. Other factors have intervened to make the result somewhat irregular; but these are too dependent on local circumstances to make their analysis possible here.

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THE CENTENARY OF THE BIRTH OF HERMANN VON HELMHOLTZ

SCIENTIFIC men of the twentieth century are so engrossed in their various pursuits (for which, happily, material equipment far in excess of anything dreamed of fifty years ago is provided) that they are in some danger of forgetting, overlooking or even ignoring the work of their predecessors of the nineteenth century.

It is upon fundamental discoveries in electricity and magnetism made during that century, and especially upon the two great generalizations, the law of the conservation of energy and the doctrine of evolution, which together constitute its great glory, that the present generation is building a brilliant, though a somewhat complicated and bizarre superstructure. It may be well, therefore, to remind the group of busy younger men who read the pages of SCIENCE, that one hundred years ago, August 31, 1821, was born one who must always be ranked with the very first—the three or four very first—of those upon whose work twentieth century science rests.

Hermann Ludwig Ferdinand, Baron von Helmholtz, was the son of a professor of philology and philosophy at Potsdam. His mother was a Hanoverian lady, a direct descendant of William Penn.

Exhibiting at an early age a fondness for the study of natural phenomena, the necessity for a vocation by which he could earn a living directed him to the medical profession and his first appointment was as an army surgeon.

At the age of twenty-one years he published his first paper announcing the discovery of nerve cells in ganglia, the beginning of a steady flow of contributions to science from his pen, interrupted only by his death more than fifty years later.

At twenty-six he had produced what was possibly the most important piece of work of his whole career, namely, his famous paper on the conservation of energy. Refused for publication by *Poggendorff's Annalen,* its value was appreciated by Du Bois-Reymond, who presented a copy of it to Tyndall (then a student at Berlin) with the remark that it was "the product of the first head in Europe." This paper fixed his place as one of that immortal trinity, Joule, Helmholtz and Kelvin, to whom we owe the establishment of this great law.

An account of Helmholtz's principal contributions to science was given in this journal not long after his death, together with the leading incidents of his long career.[1]

In one respect he was unique. No other man of his day approached him in the wide range of his intellectual activities, ranking, as he did, among the first of mathematicians, physicists, and physiologists, besides being claimed as "their own" by chemists and musicians. His contributions to the science of astronomy and of theoretical mechanics are of the highest order and in respect to his prodigious learning and the wide scope of his investigations he may be put in the same category with Francis Bacon and his own renowned fellow countryman, Alexander von Humboldt. The enormous extension of the bounds of human knowledge within the past fifty years and the irresistible tendency to specialization make it certain that there will never be an addition to this group.

Helmholtz's intellectual processes were in a marked degree typical of the race to which he belonged. They were not characterized by brilliant sorties but rather by steady advances accompanied by entrenchments so safe and strong that he was rarely if ever obliged to retreat.

There was a certain massiveness of style in both his speech and composition which made his arguments a little more difficult to follow than was the case with his two or three more brilliant contemporaries. The charm of his personality will not be forgotten by those who had the good fortune to come within its sphere. With much dignity of manner he was easy of approach, simple and modest in his mode of life, eloquent in speech in popular addresses on scientific subjects, and to those who had tried to find the man in his published works, unexpectedly delightful in social intercourse.

Physically he was not above the average in height and in figure much like that of the well-bred and well-fed German. The one small disappointment was his head which, though large, did not in shape at once proclaim his intellectual superiority, as did that of von Humboldt.

Personally chosen by the Kaiser to represent the German Empire, he came to the United States at the time of the World's Fair in Chicago in 1893. He was honorary president of the International Electrical Congress, with its "Chamber of Delegates" assembled at that time and through the kindness of friends, official and unofficial, all of whom were glad to do him honor, he was enabled to see the places and things most worth seeing in this country which he had never before visited.

On the voyage back to Germany he met with an accident which resulted finally in his death in September, 1894, mourned, as he had been beloved, by people of every nationality and all ranks of life.

The then youthful Kaiser, who was very fond of von Helmholtz and who two years earlier on the occasion of his seventieth birthday, had placed him at the head of the civil list, judged wisely in selecting him as the "highest product of the Empire" and in pure intellectual power he will always rank with the foremost men of the nineteenth century.

T. C. Mendenhall

Ravenna, Ohio

[1] Science, No. 58, February 7, 1896.

SCIENTIFIC EVENTS

DEATHS OF GERMAN MEN OF SCIENCE[1]

AT our request, Professor C. Runge, of Göttingen, has been good enough to send us the following list of leading men of science in Germany who have died since the beginning of the late war. The list is not, however, complete, and may be supplemented later. Short obituary notices of some of the men will be found in the *Geschäftliche Mitteilungen der Göttinger Gesellschaft der Wissenschaften,* 1918–19–20 (Weidmannsche Buchhandlung, Berlin S.W. 68, Zimmerstr. 94):—W. Lexis, mathematician and statistician, August, 1914; W. Hittorf, physicist, November, 1914; A. von Auwers, astronomer, January, 1915; A. von Könen, geologist, May, 1915; E. Riecke, physicist, June, 1915; P. Ehrlich, physician, August, 1915; H. Solms-Laubach, botanist, November, 1915; R. Dedekind, mathematician, February, 1916; E. Mach, philosopher and physicist, February, 1916; K. Schwarzschild, astronomer, May, 1916; R. Helmert, mathematician and physicist, June, 1917; A. von Baeyer, chemist, August, 1917; G. Frobenius, mathematician, August, 1917; A. von Froriep, anatomist, October, 1917; H. Vöchting, botanist, November, 1917; C. Rabl, anatomist, December, 1917; G. Cantor, mathematician, January, 1918; L. Edinger, physician, January, 1918; E. Hering, physiologist, January, 1918; F. Merkel, anatomist, May, 1919; S. Schwendener, botanist, June, 1919; E. Fischer, chemist, July, 1919; H. Bruns, astronomer, 1919; Th. Reye, mathematician, July, 1919; W. Voigt, physicist, December, 1919; P. Stäckel, mathematician, December, 1919; W. Pfeffer, botanist, January, 1920; O. Bütschli, zoologist, February, 1920; and W. Förster, astronomer, 1920. J. Elster, physicist, and Joh. Thomae, mathematician, have died recently. In addition to the above, several other German men of science were referred to in the obituary notice of Professor von Waldeyer in *Nature* of May 19, and news has also reached us of the following deaths not previously recorded in these columns:—Professor G. A. Schwalbe, Strassburg, on April 23, 1916, age seventy-one years; and Professor Karl von Bardeleben, editor of the *Anatomischer Anzeiger,* on December 19, 1918, age sixty-nine years.

[1] From *Nature.*

PROGRESS IN THE WORK OF MAPPING THE UNITED STATES

THE United States Geological Survey, Department of the Interior, has published about 3,000 engraved topographic maps, which represent nearly 43 per cent. of the area of the United States. These maps are the results of surveys made during a period of 34 years, and the results are fairly good in quantity and quality for a Government bureau which can go only as fast as appropriations will permit.

A few geologic maps were published by the Survey prior to 1886, some of them in atlases accompanying reports on regions in the West, and a few were published separately as photolithographs; but the 1-degree sheets of northwest New Mexico and northeast Arizona, known as Wingate and Mount Taylor, N. Mex., and Fort Defiance, Tusayan, Marsh Pass, and Canyon de Chelly, Ariz., published in 1886, were the first topographic maps printed by the Geological Survey from engraved plates.

Eight States—Massachusetts, Rhode Island, Connecticut, New Jersey, Delaware, Maryland, West Virginia, and Ohio—have been completely mapped, and the work of mapping the State of New York is more than 90 per cent. completed. Several States are actively cooperating with the Survey in this work and in 1920 contributed to it a total of nearly $200,000.

The Bulletin of the Survey containing this information continues:

> With nearly 60 per cent. of the area of the country entirely unmapped and much that has been mapped in need of resurveys, and with the largest mapping organization in the country surveying only about 40 per cent. of the area in 40 years, the logical demand is for more speed. If these maps are to serve their full purpose in promoting national development the whole country must be mapped within this generation, or, even

better, within the next decade. Practical engineers realize that every dollar of Federal and State funds appropriated for these surveys, if spent in the next twenty years, will save many dollars that otherwise must be spent by corporations and individuals in fragmentary surveys made for special purposes, and the worst feature of such an uneconomic procedure would be that it would provide no maps for the use of the general public.

THE TONGASS NATIONAL FOREST

One million cords of pulpwood on the Tongass National Forest, Alaska, has been sold by the Forest Service of the United States Department of Agriculture to the Alaskan-American Paper Corporation. The timber is from the east shore of the Behm Canal, Revillagigedo Island, about 32 miles from Ketchikan, the largest city in the Territory. The contract price of the timber was 60 cents per 100 cubic feet for spruce and cedar, and 30 cents per 100 cubic feet for all other species. The sale area covers 45,000 acres, and extends for 55 miles along the coast. Twenty per cent. of the forest is spruce, 66 per cent. hemlock, and 14 per cent. Alaska and western red cedar.

A conditional award has been made by the Forest Service to the company, pending approval by the Federal Power Commission of their application for a hydro-electric power license. The timber sale contract covers an initial period of 32 years, or until 1953. The price of the stumpage will be redetermined and fixed by the Federal Government in 1928, and every five years thereafter. Cutting must begin by October 1, 1923, thus allowing two years for organization and construction of improvements. The contract also requires the establishment of a pulp mill of not less than 25 tons capacity by October 1, 1926. A yearly cut of from 2,500,000 to 3,000,000 cubic feet is contemplated.

The award of this sale is in line with the general policy of the Forest Service for making available the timber resources of Alaska as a means of increasing the supply of pulpwood for the United States. The national forests of the Territory probably contain 100,000,000 cords of timber suitable for the manufacture of newsprint and other grades of paper. Under scientific management, experts say these forests can be made to produce 2,000,000 cords of pulpwood annually for all time, or enough to manufacture one third of the pulp products now consumed in this country.

The Alaska forests also contain the second chief essential of the pulp and paper manufacturing industry, namely, water power. No accurate survey of the power resources has yet been made, but known projects have a possible development of over 100,000 horsepower, and it is believed that a complete exploration of the national forests in southern Alaska will show not less than 250,000 potential horsepower that can be developed from water.

Forest Service cruisers are now working in Alaska collecting data for further use and development of the forests. One block of timber containing 335,000,000 cubic feet—enough to keep a 100-ton pulp mill running—has been advertised and is now ready for sale.

THE ROOSEVELT WILD LIFE MEMORIAL

The wild life memorial established by New York State to Theodore Roosevelt, The Roosevelt Wild Life Forest Experiment Station at Syracuse, is this summer conducting field investigations in New York State in the newly established seven thousand acre Allegheny State Park, which lies south of Buffalo on the Allegheny River. Here Mr. Arêtas A. Saunders is investigating the birds, and Professor T. L. Hankinson the fishes. Through friends of the station funds have been provided to investigate the beaver in the Adirondacks, where numerous complaints of the injuries have necessitated a study of their present status. This investigation is being made by Dr. Charles E. Johnson. Through the cooperation of President Howard H. Hays, of the Yellowstone Park Camps Company, and with the approval and cooperation of Director Mather, of the Park Service, and of Superintendent Albright, of the Yellowstone National Park, a field party has been at work in the Yellowstone studying wild life problems, with headquarters at Camp Roosevelt, in the north-

eastern corner of the park. Dr. Robert A. Muttkowski has been making an investigation of the fish food producing capacity of the trout streams, and Dr. Gilbert M. Smith the relation of the aquatic plants to this fish food supply. Mr. Edward R. Warren, assisted by Mr. Ellis L. Spackman, is making an intensive study of the beaver, including the mapping of their dams and ponds. Another friend of the station has made it possible for Mr. Edmund Heller, formerly naturalist on the Roosevelt African Expedition, to conduct for the station an investigation of the status of the large game mammals of the park.

SCIENTIFIC NOTES AND NEWS

AT the opening session of the New York meeting of the American Chemical Society, which will be held at Columbia University, New York City, on September 8, Dr. Edgar F. Smith, provost emeritus of the University of Pennsylvania, will preside, and addresses will be made by Mr. Herbert C. Hoover, secretary of the Department of Commerce, and Sir William Pope, president of the British Society of Chemical Industry.

THE French Association for the Advancement of Science met during the first week in August at Rouen under the presidency of M. Rateau.

DR. HENRY GORDON GALE, professor of physics in the University of Chicago, and dean of the colleges of science, has been made chairman of the division of Physical Science of the National Research Council, Washington, D. C.

DR. HENRY H. DONALDSON, professor of neurology at the Wistar Institute, has been elected a foreign corresponding member of Il Reale Istituto Lombardo di Scienze e Lettere di Milano.

PROFESSOR HEINRICH O. HOFFMAN, of the Massachusetts Institute of Technology, has been elected an honorary member of the American Institute of Mining and Metallurgy.

DR. WALTER NERNST, professor of chemistry, has been elected rector of the Berlin University.

MR. J. SHEPPARD, of the Municipal Museums at Hull, has been elected president of the British Museums Association.

DR. W. J. HUMPHREYS, of the Weather Bureau, has been elected secretary of the American Geophysical Union, to succeed Dr. H. O. Wood, resigned.

E. G. MONTGOMERY, professor of agronomy in Cornell University, has been named by Secretary Hoover as chief of the food-stuffs division of the Bureau of Foreign Commerce.

MR. ROBERT C. DUNCAN, physicist of the Bureau of Standards, has accepted a position with the Bureau of Ordnance of the Navy Department.

PROFESSOR PAUL ANDERSON, dean of the School of Mechanical and Electrical Engineering at the University of Kentucky, has been appointed director of the research laboratory of the Heat Engineering Society at Pittsburgh.

EDWARD F. MCCARTHY, of the New York State College of Forestry at Syracuse, has been assigned to the new forest experiment station of the U. S. Forest Service at Asheville, N. C.

PROFESSOR G. F. WARREN, of Cornell University, has been requested by Mr. Wallace, Secretary of Agriculture, to serve as consulting specialist to the chief of the Bureau of Markets and Crop Estimates during the reorganization and consolidation of the bureau. Professor Warren has accepted and has been granted leave of absence from Cornell until February 1, 1922.

DONALD D. SMYTH, instructor in economic geology at Cornell University, has accepted a position as geologist with the Cerro de Pasco Copper Corporation of Peru.

FOREIGN zoologists who attended the recent summer meeting of the American Phytopathological Society included Dr. E. J. Butler, director of the Imperial Bureau of Mycology, Kew Gardens, Surrey, England, and Dr. Kingo Miyabe, of the College of Agriculture, Hakkaido Imperial University, Sapporo, Japan.

DR. P. H. AASER, director of the Norwegian

State Hygienic Laboratory, Christiania, is visiting laboratories in the United States for the purpose of studying their organization, equipment and functions.

Galen H. Clevenger, consulting metallurgist to the United States Smelting, Refining and Mining Company, and vice-chairman of the Engineering Division of the National Research Council, has returned to Boston after a sojourn of four months in Mexico, organizing and directing research.

Professor H. H. Whetzel, of Cornell University, is planning to spend a year in Bermuda devoting his time to a survey of the fungi of the islands, especially those species causing plant diseases.

Professor Rollin T. Chamberlin, who has been spending the spring and summer months in the Alps, in the study of the internal motion of glaciers by the use of a delicate time-recording shear-meter devised for the purpose, reports that he has obtained records of actual shear movement. The motion takes place by little starts and stops, as might be expected in an elastico-rigid body, and not by uniform or steadily progressive motion, as might be expected in a viscous body. After completing his glacial studies, about mid-summer, Professor Chamberlin expects to give some time to the structure of the Alps and to certain geological phenomena in Spain.

The John Burroughs Memorial Association has been inaugurated at a meeting of a number of his friends at the American Museum of Natural History, the immediate purpose of the association being to protect Mr. Burroughs's home and camps and to preserve them, with their wild life, for future generations. The committee appointed to complete the organization included Dr. Frank M. Chapman, Dr. G. Clyde Fisher, Mr. Carl E. Akeley, Mr. Hamlin Garland, Judge A. T. Clearwater, Mr. Kermit Roosevelt, Mrs. Thomas A. Edison, Mrs. Henry Ford, and Mr. W. O. Roy.

A memorial window in the Episcopal Church of St. John's in the Wilderness, at Paul Smiths, N. Y., the gift of Mr. William Rockefeller, was dedicated on August 7 to the memory of the late Dr. Edward Livingston Trudeau.

We learn from *Nature* that the council of the Society of Chemical Industry has decided to institute a Messel memorial lecture in memory of Dr. Rudolph Messel. A gold medal with an honorarium will be presented to the lecturer, and for the present the remainder of the income from the bequest to the society will be allowed to accumulate.

The Royal Society proposes to erect a monument to Lord Lister in Portland-place, near the house where he lived. The necessary funds have been provided.

The park that has been constructed opposite the headquarters of the national public health service in Havana has been named for Dr. Carlos J. Finlay, and a statue portraying him was recently unveiled. It stands in the center of the park, and it is proposed to place in the corners of the park statues of the three members of the American commission, Dr. Reed, Dr. Carroll, and Dr. Lazear, who with Dr. Agramonte, confirmed the transmission of yellow fever by the mosquito.

Orestes M. St. John, formerly geologist on the surveys of Iowa and Illinois, has died at San Diego, California.

The British Medical Journal states that a scholarship has been founded at the Manchester Royal Infirmary primarily for the investigation of the claims made, especially in Germany, for the intensive X-ray treatment of cancer. The anonymous donor, however, desires that the inquiry shall include the study of the cancer problem from any point of view that may arise, and also an inquiry into the precautions that should be taken for the protection of persons working with highly penetrative rays. The scheme under which the scholar will work has been framed by a committee, consisting of Sir William Milligan, Professors H. R. Dean and W. L. Bragg, Dr. A. Burrows, Dr. Powell White, Mr. James Watts, and Dr. A. E. Barclay. Dr. C. C. Anderson has been appointed the first scholar, and will visit various centers where the intensive method is in use. He will then return

to Manchester to carry on the investigation in collaboration with other workers, who will attack the problems arising from the pathological and physiological standpoints. It is intended that the first visit should be made to Erlangen, but if time permits the scholar will afterwards visit Freiburg, Berlin and Mannheim, and certain centers in France, Holland and Sweden.

A REPORT of the British Interdepartmental Committee, which was asked to prepare a scheme for giving effect to the resolutions of the British Empire Forestry Conference with regard to a central institution for training forest officers, has been issued. The committee recommends that such an institution should be placed at Oxford and incorporated with the university. It should be governed by a board appointed one half by the departments or governments concerned, and the other half by the university. The board should have general charge of the higher course of training, of finance, and of administration. The director of the institution, who should be the professor of forestry, and the staff should be appointed by the university with the approval of the board. Pending the erection of buildings, arrangements can be made with the university for temporary accommodation. The committee says that the annual cost of the permanent staff should not at the beginning exceed £4,000 per annum. There will be a further liability on every department concerned for the university fees and subsistence, estimated at £300 a year for each probationer. Students should be selected by the departments for admission to the central institution from those who have taken a forestry degree at any university whose standard of education is approved by the board.

AT the last annual meeting of the American Physiological Society a fellowship for research in physiology was established by the generosity of Dr. Wm. T. Porter, of the Harvard Medical School. By resolution of the society, the council has been instructed to receive nominations and appoint the fellow for the year 1921–22 with a stipend of $1,200. The fellowship may be pursued at the university or institution where the particular problem being developed by the candidate can best be forwarded. The proposed program of investigation is limited only by the general purpose, namely, the pursuit of physiological research. But the program submitted by the candidate must meet the approval of the council of the society.

UNIVERSITY AND EDUCATIONAL NEWS

BY the will of the late Frances Appleton Foster, of Weston, Mass., the Massachusetts Institute of Technology receives $1,000,000 and Wellesley College $500,000.

IT is reported from the University of Manitoba that requirements for securing the gift of $500,000 from the Rockefeller Foundation will be fully met and that another new building will be erected on the college grounds.

PROFESSOR R. R. FENSKA has resigned as assistant professor in forestry at the University of Montana to become professor of forest engineering at the New York State College of Forestry, Syracuse University.

MR. DWIGHT ISELY, scientific assistant in the United States Bureau of Entomology, has resigned and has accepted the position of associate professor in the Department of Entomology, University of Arkansas, and associate entomologist in the Experiment Station.

JOHN R. DU PRIEST, professor of steam and gas engineering and design in the Rensselaer Polytechnic Institute, and consulting engineer for the Endicott Machine Corporation, Baltimore, has been appointed assistant professor of mechanical engineering at the Oregon Agricultural College.

HERBERT C. HANSON, of the University of Colorado, has been appointed assistant professor of biology in the University of Arizona.

THE Linacre chair of zoology and comparative anatomy, at Oxford, vacant by the retirement of Professor G. C. Bourne, has been filled by the appointment of Professor E. S. Goodrich, fellow of Merton College and professor of comparative embryology in the university.

DISCUSSION AND CORRESPONDENCE

THE TEMPLE HILL (ORANGE COUNTY, N. Y.) MASTODON

The 101st separate record of mastodon remains in the state of New York and the 31st record for Orange County, have been made by the recent discovery of an almost complete skeleton on the muck lands near Temple Hill about three quarters of a mile northwest of Vail's Gate Junction. The discovery is of exceptional interest. Next to the Warren Mastodon which stands in the American Museum of Natural History, the Temple Hill skeleton follows in order of completeness, all bones being present except a part of the cranium and a few of the ribs. While the skeleton appears to be somewhat larger than that of the Cohoes Mastodon in the New York State Museum, it is evident that the bones are those of a young animal, as the epiphyses are free and there is a full set of four intermediate molars in addition to the complete permanent molars, making in all 12 teeth in both jaws. The animal was found lying on its side with a quantity of triturated plant remains, apparently tamarack, lying between the ribs, evidently the creature's last meal. The skeleton was discovered about the 10th of June and was immediately acquired for the State Museum through the generosity of an appreciative friend.

The Mastodon was the most conspicuous member the mammal fauna of New York ever had, and it is perhaps of special interest to again note, with this occasion, the great abundance of these creatures in the state during the time of the recession of the post-glacial waters, especially over the swampy highlands before the land had settled down to its present altitude. After all the disturbances to which the soil of New York and its contents have been subjected, the wasting by the weather and the various other agencies attacking and destroying the integrity of such remains, the abundance of the recorded discoveries of mastodon bones in the state can only be interpreted as indicating the fact that in their heyday these animals were as abundant here as the buffalo were on the plains 75 years ago; and it is also a fact worthy of consideration by those giving attention to soil changes, that of all these 101 recorded skeletons but two or three have been preserved in anything approaching entirety.

Sherman C. Bishop
New York State Museum,
July 6, 1921

A MORE PHENOMENAL SHOOT

The July 1, number of Science records a "phenomenal shoot" which grew near Raleigh, N. C. This shoot grew from the stump of a beheaded tree of *Paulownia tomentosa* in one season to the length of 19 feet 5 inches; had twenty internodes, and was 7.75 inches in circumference at the base. This shoot is thought by Mr. Wells to be "a record for the tree type of woody plant in the temperate zone."

During the past season the writer kept track of a shoot which grew from stump of a beheaded tree of *Paulownia tomentosa*. This shoot grew during the season of 1920 to a length of 21 feet 6 inches, it has twenty-four internodes and is ten inches in circumference at the base. One of the leaves, measured in the latter part of July, was 38 inches in largest dimension. This shoot grew in clay loam soil residual from granite on property adjoining the campus of the University of North Carolina, Chapel Hill, N. C. The shoot is on exibition in the Geological Museum of the University.

W. F. Prouty
Chapel Hill, N. C.

A PHYTOPHTHORA PARASITIC ON PEONY

Early in May the writers received from Mrs. George Ray, of Erie, Pa., some blighted peonies. Since the cause of the trouble was not at once apparent, cultures were attempted from the diseased portions. These yielded at once a pure growth of *Phytophthora*. As the writers are not aware of any previous report of a *Phytophthora* as a parasite on this host, a brief description of the disease and the causal organism is here made a matter of record, pending further investigation.

Upon the original specimens, which were in fine condition when received, the disease was manifest as a necrotic condition of the bud, involving also the surrounding leaves and extending for several inches down the stem. In general appearance the symptoms are similar to those caused by *Botrytis,* although the infected areas are darker brown or black. No evidence of external fruiting of the parasite was found either upon the original specimens or upon subsequent artificially infected plants. Several attempts were made to isolate a similar organism from diseased peonies in the vicinity of State College, so far without success. Inoculations of the pure culture into healthy peonies, however, readily produced infections, and the characteristic "blighted" symptoms, from which the organism was reisolated with ease. Inoculations were made upon plants growing out doors with pure culture, using bits of mycelium and zoosporangia, and were successful both with and without wounding of the host. The characteristic symptoms appeared in from three to six days.

The *Phytophthora* in question grows readily upon a variety of artificial media, and in this respect differs from *P. infestans.* The growth is somewhat sparse upon the surface of agar slants, but is abundant beneath the surface.

It has been grown on ordinary beef peptone agar, potato agar, corn meal agar and in beef broth, where it grows luxuriantly submerged but not at the surface. Zoosporangia are produced in abundance and measure 16.7–22.3 μ x 20.4–29.7 μ. These measurements correspond closely to those for the zoosporangia of *P. infestans*[1] but are somewhat broader than those of *P. Thalictri*[2] which would appear to be its closest relative so far as hosts are concerned. Oospores have not been observed either in cultures or tissue sections.

H. W. THURSTON, JR.
C. R. ORTON
PENNSYLVANIA STATE COLLEGE

[1] Rosenbaum, J., *Jour. Agr. Res.,* 8: 233–276. 1917.

[2] Wilson, G. W., *Bull. Torr. Club,* 34: 387–416. 1907.

QUOTATIONS

FAIR WEATHER PREDICTIONS

ONE fixed determination in the office of this *Journal* has been that the monthly issue shall always be ready to go into the mails on the appointed date. The staff has loyally cooperated in this effort, regardless of hours of work. With the notice given in April of an impending strike on the first of May, the matter passed beyond our hands, and when the strike materialized, the record of promptness was effectually shattered.

Fortunately for our peace of mind, the Council of the Society, representative of the membership, had agreed, by formal resolutions adopted at the Rochester Meeting, to wait indefinitely for journals, thereby materially assisting the printer in his stand against what he considered unjust demands from the striking employees.

The labor conditions affected most seriously the hand composition work in the printing office, and this force has been recruited on an open shop basis until it is now greater in number than before. Naturally, men not accustomed to printing chemical articles have had to be developed and trained, so that the new force, at first quite inefficient, is gaining steadily in efficiency. There is now every prospect that the August issue will quickly follow and that the September issue will go into the mails promptly on the last day of August. Pardon anachronisms in the editorials of the July and August issues, in view of the unusual situation.

With all of these troubles upon us, there has been one pleasurable aspect of the situation, the hearty cooperation of both authors and advertisers in the effort to get our work upon a right and permanent basis. Letters received, especially from advertisers, make us feel that there is a strong bond between this *Journal* and its patrons, and we desire here to express our sincere appreciation of that spirit.

One further word only to the authors of papers is added. The preparation of reprints requires a considerable amount of hand composition work and remaking of material. We

urge authors to be extra patient in the matter of receiving their reprints. If the present composition force is diverted to work on reprints, the issue of each of the journals of the society would be delayed to that extent. We have, therefore, taken the liberty of authorizing the printer to postpone the making up of reprints from this *Journal,* and to put all emphasis upon catching up with the regular schedule of publication. We are confident of an extension of loyal cooperation on the part of our contributors.

To adopt the language of the Weather Bureau: "For to-morrow: fair weather."—*Journal of Industrial and Engineering Chemistry.*

SPECIAL ARTICLES

NOTE ON THE USE OF THE DUBOSCQ TYPE OF COLORIMETER FOR THE DEMONSTRATION OF DIFFERENCES IN SURFACE TENSION

Although there are many interesting experiments by which the phenomena of surface tension can be demonstrated to students, as a rule they fail to give a basis of direct visual evidence of the main force concerned. Consequently any procedure which will enable the student to demonstrate to himself in a semi-quantitative manner, that there are differences in the ability of different liquids to sustain themselves by the forces inherent in their surfaces, should assist in an understanding of the underlying principles.

Such a demonstration can be staged by the use of the Duboscq type of colorimeter. Moreover the effects of the additions of minute amounts of various substances to water, on the surface tension of the latter can be strikingly shown.

If that point on the scale at which the dry lower surface of the plunger just comes in contact with the surface of a liquid in the cup or small beaker of about 5 cm. diameter resting upon the cup support is taken as the base line, it is possible to measure with a considerable degree of constancy the height in tenths of millimeters to which the plunger can be raised above the surface of the liquid before the clinging column of fluid breaks contact and slides back into the container. This affords a clear idea of the principle of surface tension from the fact that an obviously weighable volume of liquid is lifted and held above the main surface of fluid by the force of the liquid surface in contact with the plunger.

When a comparison is made of the height to which the plunger can be raised from contact with the surface of such substances as water, ether, absolute alcohol, acetone and toluol, it becomes at once evident that different liquids have different abilities to cling to the plunger surface and hence different surface tensions. When a bit of soap is swished around in the water in the beaker and then removed, the marked decrease in surface force is made plain by the decrease in the height to which the plunger can be raised before contact is broken. A similar result is obtained when a trace of amyl alcohol is added to the water. When a bit of picric acid is dissolved in the water in the beaker the opposite effect is observed and is of sufficient magnitude to demonstrate why picric acid solutions "bump" when heated.

TABLE

Substance	Height in 0.1 mm.	a^2mm^2
Water	40	14.68
Toluol	29	6.72
Acetone	28	6.18
Absolute alcohol	27	5.08
Ether	25	4.61
Water plus soap	36	
Water plus amyl alcohol	33	
Water plus picric acid	42	

The accompanying table shows the values obtained for the substances mentioned. The second column of figures gives the values for the same compounds as copied from Landolt, Bernstein and Roth's tables, 4th edition, in terms of a^2mm^2. The correspondence is pleasingly close, but is of course accidental since contributing factors other than the height in millimeters are obviously involved, though in this group they happen to be mutually compensating.

These few examples suggest the availability of the plunger-cup mechanism as a basis for the development of an accurately calibrated piece of apparatus for the determination of

absolute surface tension values in terms of dynes. Such an instrument with its proper formula might well be of service in such measurements because of its simplicity of manipulation.

FREDERICK S. HAMMETT
THE WISTAR INSTITUTE OF ANATOMY AND BIOLOGY

VARIATION OF INDIVIDUAL PIGS IN ECONOMY OF GAIN

IN a very interesting article by Ashby and Malcomson, published in the *Journal of Agricultural Research,* Volume XIX., pages 225–234, the following statement is made on page 232:

> The resultant coefficient of correlation
>
> $$r = -0.452 \pm 0.068$$
>
> shows a distinct negative correlation between rate of gain and economy of gain, entirely disproving the apparent relation shown by Tables IX. to XV.

This conclusion is very interesting, especially since it is contrary to the usual belief and usual experience. The writer has recalculated the coefficient of correlation from Table XVI. on page 232 and found a different result from that given by Ashby and Malcomson in that $r = -0.166 \pm 0.083$ which is not a significant correlation.

Thinking that a different treatment of the data might throw further light on this point, a new correlation table was made between the rate of daily gain and the amount of feed required to produce 100 pounds of gain. This correlation was found to be

$$r = +0.140 \pm 0.083.$$

This is not a significant correlation, but it is interesting to note that it is positive instead of negative.

Again Ashby and Malcomson combined cases of animals fed on pasture and of those fed in the dry lot. From a statistical point of view, this is not advisable, since the food derived from the pasture was not taken into consideration.

The average daily gain of 27 animals fed on pasture was 1.14 pounds and the average amount of feed required to produce 100 pounds of gain was 361.2 pounds. The average daily gain of 36 animals fed in the dry lot was 1.41 pounds and 391.8 pounds of feed were required to produce 100 pounds of gain. It is readily seen from these figures that the rate of gain among pasture fed animals was less than among those of the dry lot, and at the same time the amount of feed for 100 pounds of gain was less, because the part of the feed from the pasture was not taken into consideration.

Separate correlations were found for these two groups. In the pasture-fed group

$$r = -0.181 \pm 0.126,$$

while in the dry lot group

$$r = -0.036 \pm 0.112.$$

Both of these are negative but not significant. When treated together

$$r = +0.140 \pm 0.083,$$

a positive correlation but still not significant.

One can not accept the conclusion of Ashby and Malcomson that there is a negative correlation between the rate of gain and economy of gain for the following reasons:

1. On the basis of their own data, there is no significant correlation.

2. From a statistical standpoint it is not legitimate to pool cases of animals fed on pasture and animals fed in the dry lot, for the purpose of determining the correlation between rate of gain and economy of gain since the two groups are dissimilar.

Other factors which might influence the results are initial weight, age, length of feeding period and methods of feeding. In their discussion, the possibility is suggested of using these individual differences as a basis for selecting strains which are more economical producers. But these variations which they found can not be said to be genetic because of too many uncontrolled factors such as cited above. It is interesting to note that even when pigs are self-fed, selection is exercised by individual pigs in the kinds of feed which they consume. The following table taken from a preliminary report by Ashby on page 201 of the 1916 *Proceedings of the*

American Society of Animal Production illustrates this point:

PERCENTAGE COMPOSITION OF RATION

Feed	Range in Per Cent.
Corn	85.21 — 90.65
Shorts	1.53 — 4.11
Tankage	6.22 — 12.10

The method of individual feeding which Ashby and Malcomson used seems to be the only method available for the study of some of the problems of animal production and one to which more attention must be given, but there are many factors operative rendering such a method difficult.

E. Roberts
Agricultural Experiment Station,
University of Illinois

THE AMERICAN CHEMICAL SOCIETY

(*Continued*)

DIVISION OF RUBBER CHEMISTRY

W. W. Evans, *chairman.*
Arnold H. Smith, *secretary.*

The day was devoted entirely to a discussion of the tentative procedure for the analysis of rubber goods.

Reports from the executive committee, abstract committee, accelerator committee, and physical testing committee were read.

Thermal conductivity of some rubber compounds: A. A. Somerville. Rubber mixes have been made containing different amounts of sulphur, with and without accelerators, with equivalent volumes of various fillers, and given a range of cures. The thermal conductivities of these samples have been compared and the results of the test indicate a wide variation in thermal conductivities due to different fillers being used.

Contribution to the knowledge of the resins of Hevea rubber: G. Stafford Whitby and J. Dolid. A number of crystalline substances have been isolated from the acetone extract of plantation Hevea rubber. At least two of these are sterols. The less soluble of the two constitutes roughly 5 per cent. of the extract, it decomposes without melting, and forms an optically active acetate crystallizing in leaflets and melting at 169°. With this sterol another substance, not yet isolated in a state of purity, was associated. The soluble sterol consisted of matted, flexible leaflets, melting at 127°. A substance, optically inactive, melting at 62°, constituting roughly 5 per cent. of the extract, was obtained. Quebrachitol was isolated from the extract, and was found to occur generally in sheet and crepe. The results of a quantitative study of the oxidation of caoutchouc under the catalytic influence of copper are reported.

The solubility of gases in rubber as affecting their permeability: Charles S. Venable and Tyler Fuwa. It was found that when rubber absorbs gas, the gas is held in true solution and not by absorption. In the case of carbon dioxide, which has about an average solubility, the amount of gas thus held in true solution by the rubber is directly proportional to the pressure and decreases with increasing temperature. This solubility is unaffected by degree of vulcanization or by the presence of compounding ingredients. Other gases seem to behave in a similar manner. Relative solubility values obtained for various gases in rubber show that there is a general relationship between the solubility and density of the gas and its rate of penetration through rubber. These results, in general, confirm the original hypothesis of Graham that the penetration mechanism consists in the solution of the gas at one surface of the rubber and the diffusion of the undissolved gas through the rubber and its evaporation at the other surface. The indications are, however, that the actual size of the gas molecule is also an appreciable factor. A striking relationship between the solubility of various gases in rubber and in water has been noted.

Reactions of accelerators during vulcanization. III. Carbo-sulphydryl accelerators and the action of zinc oxide: C. W. Bedford and L. B. Sebrell. Reactions of accelerators producing mercapto groups by action of sulfur are discussed. Thio carbanilide with aniline in benzol solution will dissolve zinc oxide and will vulcanize a zinc oxide cement at room temperature. Other zinc salts of mercaptans such as zinc thiophenol and zinc-ethyl-xanthate will vulcanize pure gum cements containing sulfur at room temperature. These accelerators are free from nitrogen or alkali and also function in press or steam cures. Without zinc oxide no accelerator has been found which will vulcanize at room temperature. Zinc salts of carbo-sulphydryl accelerators furnish the key to the paper.

The influence of piperidine-piperidyl-dithiocarbamate on vulcanization: G. Stafford Whitby and O. J. Walker. Tested in a 90 : 10 rubber-sulfur mix, 1 per cent. of the base mentioned is

found to reduce the time of cure by seven eighths, and even at 130° to lead to curing in about one third of the time required at 141° in its absence. At the optimum cure rubber containing the base showed (*a*) a noticeably lower sulfur coefficient, (*b*) a very considerably higher breaking stress, (*c*) a noticeably smaller elongation, and (*d*) a lower position of the stress-strain curve (strains as ordinates) than did rubber from which the base was absent. On aging for 7 months, vulcanizates prepared with the base behaved in a manner essentially similar to that shown by vulcanizates prepared without it; the stress-strain curves coming down the paper to a similar extent and the breaking points altering in a similar way.

A rapid bomb method for the determination of sulfur in rubber compounds: W. W. EVANS and RUTH E. MERLING.

The direct determination of the sulfur of vulcanization: S. COLLIER and MICHAEL LEVIN. The sulphur actually combined with the rubber is determined by dissolving the rubber and polyprene sulphide in cymene. The solution is diluted with petroleum ether and filtered after the fillers have settled out. The filtrate containing the polyprene sulphide is evaporated to dryness by heating on the steam bath and by means of a gentle current of air. The residue is dissolved in nitric acid and the solution evaporated to dryness. Three c.c. of nitric acid are added to the residue and then 5 grams of sodium carbonate. The mixture is fused and the amount of sulphur determined.

Volume increase of compounded rubber under strain. (Lantern.) (With comments on the work of H. F. Schippel.): HENRY GREEN.

A general round table discussion followed on the topics of factory control of vulcanization, testing of crude rubber as received at the factory, reactions between sulfur and various softeners, and others.

DIVISION OF BIOLOGICAL CHEMISTRY

A. W. DOX, *chairman.*
H. B. LEWIS, *secretary.*

A study of the highly unsaturated fatty acids occurring in fish oils: G. D. BEAL and J. B. BROWN. A proximate determination of the composition of five commercial fish oils was made by converting a kilo of each of the oils into its methyl esters by a modified Haller methanolysis, distilling these into ten-degree fractions under reduced pressure and analyzing these fractions. Evidence for the presence of myristic, palmitic and clupanodonic acids was given, and also for acids more highly unsaturated and of greater molecular weight than clupanodonic acid. When the refractive indices of the fractions were plotted against the corresponding iodine numbers and mean molecular weights of the acids, curves which were nearly straight lines were produced. The analytical data showed a decided similarity for the oils examined, which included salmon, menhaden, herring, cod and sardine oils. The pure highly unsaturated acids were prepared in more than 50 per cent. yield by reduction of their methyl ester polybromides in methyl alcohol with zinc dust. The mean molecular weight of these acids by titration was over three hundred, a value much too high for clupanodonic acid. Distillation of the methyl esters of these acids and analysis of the fractions gave good evidence for the presence of the following acids—hexadecatrienoic, $C_{16}H_{26}O_2$, clupanodonic, $C_{18}H_{28}O_2$, arachidonic, $C_{20}H_{32}O_2$, eicosapentenoic, $C_{20}H_{30}O_2$, docosapentenoic, $C_{22}H_{34}O_2$, and docosahexenoic, $C_{22}H_{32}O_2$.

Further studies on the mosaic disease of spinach: S. L. JODIDI. Mosaic disease affects many crops of vast economic importance such as the Irish potato, tobacco, corn, sugar beet, sugar cane, spinach, cabbage, lettuce, tomato, cucumber, and others. It seemed quite desirable to study the mosaic disease of at least one crop—in this case spinach—from various angles and by various methods. The results of the investigation have led to the following conclusions: (1) The physical and chemical properties of the soil taken from under diseased spinach plants were found to approach very closely those of the soil taken from under healthy plants. (2) The differences in the biological behavior of the two soils under consideration, as shown by their ability to ammonify various organic nitrogenous compounds, were so small as to be negligible. (3) The mosaic disease of spinach does not seem to be due to malnutrition, since in the experiments reported the diseased condition of the plants can not be ascribed to physical, chemical and biological conditions obtaining in the soil.

Chemical, physical and insecticidal studies of arsenicals: F. C. COOK and N. E. MCINDOO.

Cysteine as a product of the intermediary metabolism of cystine: H. B. LEWIS and LUCIE E. ROOT. After the administration either orally or subcutaneously of 1-phenyluraminocystine to rabbits,

a product was isolated from the urine which has been identified as the phenyluramino derivative of cysteine.

Avian versus mammalian dietary requirements: W. D. Richardson.

The influence of fasting and of vitamine B deprivation on the non-protein nitrogen of rat's blood: H. A. Mattill. The non-protein nitrogen of the blood of fasting rats is 30–40 per cent. higher than that of normal animals, the most marked increase being in urea. Creatinine and creatine are very slightly increased as are total solids. The blood of rats deprived of vitamine B shows practically no variation from the normal except that creatinine is at the fasting level and creatine is slightly higher than the fasting figure. In the present state of uncertainty with reference to the determination of blood creatine and creatinine these variations are of little significance but at least the total solids, the non-protein nitrogen and the urea fraction in the blood of rats on a diet deprived of vitamine B are normal and not increased as in the blood of fasting rats. The desirability of obtaining information on the gaseous metabolism as well as on creatine metabolism in animals deprived of vitamine B is suggested.

The effect of temperature and the concentration of hydrogen ions upon the rate of destruction of the antiscorbutic vitamin: H. C. Sherman, V. K. LaMer and H. L. Campbell. The time curve of the destruction in filtered canned tomato juice follows neither the unimolecular nor the square root law of Schütz when the heat treatment is conducted at 60°, 80°, 100° C. for 1 to 4 hours. Empirically the destruction in these cases was found to be a function of the fourth root of the time. The temperature coefficient of the destruction of the vitamin was low: Q_{10} (60°–80°) $=1.23$; Q_{10} (80°–100°) $=1.12$. The low temperature coefficient and the colloidal nature of the material indicate that in tomato juice, at least, the reaction is of the heterogeneous type with diffusion playing an important rôle. Oxidation by oxygen can not be an important factor in these experiments. The velocity of the reaction at 1 hour at 100° C. progressively increases with decreased (H^+). The omission of reacidification following such treatment produces an even greater destruction due no doubt to the continued action of the greater (OH^-) even at low temperature.

The quantitative measurement of the antiscorbutic vitamin: H. C. Sherman, V. K. LaMer and H. L. Campbell. Guinea pigs are fed a basal diet consisting of oats 59 per cent.; skim milk powder heated 2 hours at 110° C., 30 per cent.; butter fat, 10 per cent.; NaCl, 1 per cent. In addition to the determination of the minimum protective dose of antiscorbutic the degrees of scurvy produced, as measured by the autopsy findings, retardation in growth, and symptoms in life, are determined for a series of animals receiving graduated sub-protective doses of antiscorbutic food. When the dosage is calculated per unit of body weight it is possible to distinguish the degrees of scurvy produced for addenda of antiscorbutics differing by 15 per cent. or less. The per cent. destruction due to a deleterious process is obtained by comparison of the degree of scurvy produced in a series of standard animals fed a similarly graduated series of doses of the treated product. The probable error of the mean in a series of 5 or more animals is less than 4 per cent.

The action of nitrous acid on casein: Max S. Dunn and H. B. Lewis. Deaminized casein has been prepared by the action of nitrous acid on casein. Analysis by the Van Slyke method for free amino nitrogen showed the absence of free amino nitrogen. Casein and deaminized casein were hydrolyzed and analyzed by Van Slyke's procedure for the determination of characteristic groups. In harmony with the current theories as to the nature of the free amino groups of the protein molecule, lysine was found to be absent in deaminized casein. No other notable differences were detected between casein and deaminized casein. Tyrosine was determined by the Folin-Denis colorimetric method. Deaminized casein was found to contain a lower percentage of tyrosine than casein.

Lipase studies. The hydrolysis of the esters of some dicarboxylic acids by the lipase of the liver: A. A. Christman and H. B. Lewis. On the basis of the acidity developed when the lipase of hog liver was allowed to act on the diethyl esters of succinic and malonic acids, it is considered that the reaction proceeded to an equilibrum which corresponded to the removal of one ethyl group from the diethyl esters. A substance was obtained from the products of the reaction between diethyl malonate and lipase which gave on analysis figures which were in good agreement with those required for monoethyl malonate. Lipase of hog liver was not able to hydrolyze monoethyl malonate or potassium ethyl malonate.

Vitamines in milk: (By title.) H. STEENBOCK, MARIANA T. SELL and E. M. NELSON. The writers have been able to substantiate Osborne and Mendel's findings that at least 15 c.c. of milk are required daily to cover a young rat's requirements for the water soluble vitamine. Generally speaking, milk can not then be considered a good source of either the water soluble vitamine or the antiscorbutic vitamine, as our previous investigations and those of others have already shown. This conclusion is emphasized by the fact that it has now been found that approximately 2 c.c. of milk are necessary to furnish a sufficiency of the fat soluble vitamine, which shows that milk fully equals in value, with one exception, our best known sources of this dietary constituent. This figure can not be taken as absolute, however, for even under practical farm conditions a many fold variation in fat soluble vitamine content easily obtains as the ration of the cow changes. Sudden variations in vitamine content are probably in large part prevented by drainage of the storage reservoirs of the animal. Liver tissue for one has been found to depreciate in fat soluble vitamine content on a fat soluble vitamine poor diet. Yet in the aggregate even this effect can not be very prolonged.

Further experiments on the isolation of the antineuritic vitamine: ATHERTON SEIDELL. In a previous paper (Public Health Reports, April 1, 1921) it was shown by control tests on pigeons that the precipitate obtained by addition of ammoniacal silver nitrate to a purified vitamine extract made from yeast "activated" fuller's earth is highly antineuritic. This vitamine silver complex is amorphous and its conversion to a crystalline condition has not been effected. Attention has, therefore, been directed towards the preparation of crystalline derivatives of the active constituent of the compound. Among those which have been obtained are the picrate, nitrate and what appears to be the free base. Of these, the picrate does not give a constant melting point and yields picric acid by ether extraction. The nitrate melts with decomposition at 146°. The base is very slightly soluble in strong alcohol but so soluble in water that a viscous pellicle is usually obtained on slow evaporation of the aqueous solution. The physiological testing of these products has not been completed.

The occurrence in the animal organism of two types of lipases: VICTOR E. LEVINE and FRANCIS J. MCDONOUGH. Lipase was found in all the organs of the pig that have thus far been examined. By the action of bile or bile salts (sodium glycocholate and sodium taurocholate), the lipolytic enzyme may be differentiated into two types: α-lipase and β-lipase. The former is observed only in the pancreas or in its secretions. Its activity is accelerated by bile or bile salts and by heated blood serum. The latter is found in all the other tissues tested. Its activity is also accelerated by serum, but is markedly inhibited by bile or bile salts. The contrasting effect of bile salts therefore serves to distinguish the exo-lipase of the pancreas from the endo-lipase of all other organs. In the light of these experimental results Cohnheim's contention, that no difference exists between an exo-enzyme and its corresponding endo-enzyme, is untenable. In view of the similarity in the action of serum upon α-lipase and upon β-lipase it is probable that the two types possess the same groupings or chemical nuclei in their molecular structure. The dissimilarity in the effect of bile salts may be the result of tautomeric modification, or may indicate a difference in stereoisomeric configuration or a variation in the side chains or substituents in the major groupings of the enzyme molecule.

The distribution of lipolytic activity in the kidney: VICTOR E. LEVINE and SALVER A. GIANELLI. Studies were made of the lipolytic activity of the kidney of the rabbit, dog, sheep, pig and cow. The source of enzyme was a chloroform-water extract of the anatomical regions of the kidney, cortex, upper medulla and lower medulla (papillary portion). Ethyl acetate, ethyl butyrate, methyl salicylate, olive oil and castor oil served as zymolytes or substrates. Quantities of extract equivalent to 80 mgs. of tissue were employed, and the lipolytic activity determined by titration, in the presence of phenolphthalein, with N/25 or N/50 sodium hydroxide. When olive oil or castor oil was used, titrations were made after the addition of alcohol. The two kidneys in the same animal always show a distinct variation in lipolytic activity. The greatest lipolysis is regularly observed in the cortex, the least in the lower portion of the medulla (papillary region). The relative extent of lipolytic activity corresponds to the relative distribution of fat in the kidney as recently reported by Christianna Smith (*Amer. Jour. Anat.*, 1920, 27, 69). This distribution in accordance with the anatomical divisions of the kidney explains the preponderating occurrence of fat in the cortex under normal conditions

and also under those of fatty degeneration. The large number of contradictory findings concerning the presence or absence of enzymes in the kidney and the inability of investigators to find normals for this tissue rest upon the failure on their part to consider the kidney with reference to its anatomical regions.

Uric acid and phenols in the saliva: M. X. Sullivan and Paul R. Dawson. Salivas collected in 30 minutes under stimulus of chewing paraffin were freed from protein by treatment with 10 per cent. trichloracetic acid followed by 10 per cent. sodium tungstate in 2/3 *N* H_2SO_4 and were then tested for uric acid and phenol. The uric acid precipitated by silver lactate in 5 per cent. lactic acid, after appropriate treatment, was estimated colorimetrically. The phenols in the filtrate from silver urate, after appropriate treatment, were estimated colorimetrically with resorcinol as standard. Both uric acid (urates) and phenols (free and conjugated) were found in normal saliva and in the saliva of pellagra patients.

Extraction and estimation of lipoids in cereal products: O. S. Rask and I. K. Phelps. Ether extracts from cereal products, raw or cooked, do not represent their total lipoid content (fatty matter). A preliminary treatment of such products by an ammoniacal alcohol solution and a subsequent extraction by a mixture of ethyl ether and petroleum ethers in a manner similar to that specified in the Roese-Gotlieb method for fat in milk, yields higher results which appear to represent more nearly the true lipoid content of cereal products. Ether extracts of uncooked cereal products represent on the average 65 to 70 per cent. of the results obtained by the above procedure.

Estimation of phospholipins in cereal products: O. S. Rask and I. K. Phelps. A further study of the lipoids referred to in the preceding abstract indicates that they contain all phospholipins present in cereal products and the lipoid phosphorus of cereals may be estimated by determining the phosphorus content of their lipoids thus obtained.

Resemblance of the thermal death point of bacteria to chemical reaction: W. D. Bigelow. The data presented by W. D. Bigelow and J. R. Baty in the *Journal of Infectious Diseases* for December, 1920, can be expressed in the form of semilog curves which are straight lines between the temperatures of 105° and 125° C. At higher temperatures the experimental evidence is inconclusive because of error produced by the time required for heat to penetrate to the center of the tubes. For this reason the time secured by extending the semilog curves mentioned above is more nearly correct than the experimental data for temperatures above 125° C. At temperatures below 105° C. the time necessary for the destruction of spores appears to be less than would be indicated by an extension of the semilog curves. The semilog curves showing the thermal death point of spores of the fifteen bacteria referred to are all parallel to each other. It is suggested that if other spores follow the same law the position of the curve showing the time necessary to destroy the spores at various temperatures is fixed by the determination of the time at one temperature. It is suggested that the thermal death point of non-spore-bearing bacteria at different temperatures will probably follow the same law or a similar law.

The intensity of light necessary to initiate a photochemical change in the retina: E. L. Chaffee and W. T. Bovie. This investigation concerns the potential differences which are set up in the retina when it is illuminated. An apparatus is described in which the differences in potential are amplified by audions through stages. An Einthoven galvanometer is used. The changes are recorded photographically. A single exposure gives three distinct deflections. It was shown as a new contribution that these deflections are greatly influenced by experimental conditions, such as the length of time which has elapsed since the eye has been excised. Over a range of intensities which are very close to the threshold for human vision the height of the first deflection is proportional to the amplitude of the light vibration.

An "antidote" for a "poisoned electrode": W. T. Bovie.

Abiotic action of rays due to ozone and the heat sensitization of protoplasm by ultra-violet light: W. T. Bovie. The experiments concern the processes which take place in *Paramecium caudatum* during the time between the exposure to fluorite rays and the appearance of the first visible effects of the radiation; that is, during the so-called "latent period." The latent period is shorter and the effects of the rays are more intense the higher the temperature to which the organism is raised and the longer the time the organism is maintained at the higher temperature. No similar effects are observed if the organism is subjected to the increased temperature immediately before the radiation instead of after it.

Charles L. Parsons,
Secretary